Public Workshop

Risk-Informing The Technical Requirements of 10CFR50

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One White Flint - NRC Auditorium

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AGENDA

1. Introduction/Background
2. San Onofre Task Zero Safety Evaluation Report
3. Key Points from Safety Evaluation Report
4. Petition for Rulemaking
   a. 10CFR50, Appendix A, GDC 41
   b. 10CFR50.44
5. Summary

OBJECTIVE - PILOT PROGRAMS

- The objective of the pilot programs will be to demonstrate a more objective and efficient way to maintain adequate protection of public health and safety, to promote the common defense and security, and to protect the environment than the present detailed prescriptive regulatory process.

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Integrated Approach

"Whole Plant"

Cost

Generation

Risk

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BASIS

- The primary responsibility for the "public health and safety" of a nuclear unit lies with the people at the site who are running the nuclear unit.
- The regulatory process that oversees the nuclear unit must ensure "adequate protection of public health and safety."

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PUBLIC HEALTH RISK

1. Is different for each nuclear unit.
2. Changes with time.

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Dr. Thomas Pigford, Kemeny Report, October 1979, Separate views.

16. The Major Problems with NRC's Approach to Reactor Safety

The Commission (Kemeny) report has identified many mistakes by NRC personnel in their handling of the TMI-2 accident and deficiencies in NRC's regulatory practices. However, this criticism does not reach some essential elements of the problem. I believe that the following are some of the more important problems at NRC:

... Lack of quantified safety goals and objective. When a safety concern is postulated, there is no yardstick to judge the adequacy of mitigating measures.

... Inability to set priorities and to allocate resources in proportion to the estimated risk to the public. In my view, a disproportionate effort is being required for some issues which have only a marginal impact upon risk to the public.

... Lack of experienced staff. An undesirably large proportion of NRC staff and management have little or no practical experience in designing or operating the equipment which they regulate.

... Arbitrary requirements. Too many of the NRC requirements are mandated without valid technical back-up and value-impact analysis.

... A stifling adversary approach. The existing process inhibits the interchange of technical information between the NRC and industry. It discourages innovative engineering solutions.

... Ineffective evaluation of operations. NRC has no effective system for evaluating data from operating plants. Data should be analyzed systematically to identify trends and patterns.

... Lack of a comprehensive system approach to the whole plant. A large percentage of the NRC staff are specialists focusing upon narrow topics. There are relatively few systems engineers within NRC who can integrate individual safety features into an overall concept and who can place issues into perspective.

... An overwhelming emphasis on conservative models and assumptions. Realistic analyses are needed to identify the margins of safety and to aid competent decisions.

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ISSUES FOR NUCLEAR PLANTS IN A DEREGULATED ELECTRIC UTILITY INDUSTRY

by

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INTERNATIONAL TOPICAL MEETING ON
SAFETY OF OPERATING REACTORS
SAN FRANCISCO, CALIFORNIA

OCTOBER 11-14, 1998

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Exerpt from the San Onofre Task Zero Safety Evaluation Report:

"The overall public risk and radiological consequences from reactor accidents is dominated by the more severe core damage accidents that involved containment failure or bypass."

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Excerpts from the San Onofre Task Zero Safety Evaluation Report:

"Subsequent risk studies have shown that the majority of risk to the public is from accident sequences that lead to containment failure or bypass, and that the contribution to risk from accident sequences involving hydrogen combustion is quite small."

"As mentioned in the previous section, the risk associated with hydrogen combustion is not from design-basis accidents but from severe accidents."

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Excerpts from the San Onofre Task Zero Safety Evaluation Report:

"Although the recombiners are effective in maintaining the Regulatory Guide 1.7 hydrogen concentration below the lower flammability limit of 4 volume percent, they are overwhelmed by the larger quantities of hydrogen associated with severe accidents which are typically released over a much shorter time period (e.g., 2 hours)."

"From this information, the NRC staff concludes that the quantity of hydrogen, prescribed by 10CFR50.44(d) and Regulatory Guide 1.7, which necessitates the need for hydrogen recombiners and its backup the hydrogen purge system is bounded by the hydrogen generated during a severe accident. The NRC staff finds that the relative importance of hydrogen combustion for large, dry containments with respect to containment failure to be quite low. This finding supports the argument that the hydrogen recombiners are insignificant from a containment integrity perspective."

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Excerpt from the San Onofre Task Zero Safety Evaluation Report:

"In a postulated Loss of Coolant Accident, the San Onofre Nuclear Generating Station Units 2 and 3 Emergency Operating Instructions direct the control room operators to monitor and control the hydrogen concentration inside the containment after they have carried out the steps to maintain and control the higher priority critical safety functions. The key operator actions in controlling the hydrogen concentration are to place the hydrogen recombiners or hydrogen purge system in operation which involves many procedural steps. These hydrogen control activities could distract operators from more important tasks in the early phases of accident mitigation and could have a negative impact on the higher priority critical operator actions."

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Key Points - Combustible Gas Control

Public Health Risk

Severe Accidents - Not Design Basis Accidents

Containment integrity when fission products present

Existing hydrogen recombiners and purge ineffective

Existing procedures can distract operators

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My proposed revised 10CFR50, Appendix A, General Design Criteria 41, Containment atmosphere cleanup, is as follows:.

As necessary, systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided, consistent with the functioning of other associated systems, to assure that reactor containment integrity is maintained for accidents where there is a high probability that fission products may be present in the reactor containment.

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My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

a.) An inerted reactor containment atmosphere shall be provided for each boiling light-water nuclear power reactor with a Mark I or Mark II type containment.

b.) Each licensee with a boiling light-water nuclear power reactor with a Mark III type of containment and each licensee with an ice condenser type of containment shall provide its nuclear power reactor containment with a hydrogen control system. The hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume).

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My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

c.) All light water reactors with other types of containment than in (a) or (b), must demonstrate that the reactor containment (based on realistic calculations) can withstand, without any hydrogen control system, a hydrogen burn for accidents with a high probability of causing severe reactor core damage. If such an evaluation of reactor containment capability can not be demonstrated, then the licensee shall provide a hydrogen control system per the backfit process. This hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume)

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My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

d.) Each light-water nuclear power reactor shall be provided with high point vents for the reactor coolant system, for the reactor vessel head, and for other systems required to maintain adequate reactor core cooling if the generation of noncondensible gases in these systems would realistically lead to severe reactor core damage during an accident. High point vents are not required, however, for the tubes in U-tube steam generators.

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Containment Integrity

Important Parameters

1. Containment capability during severe accidents
    a. Dry containment
    b. Suppression containment

2. Containment heat removal during severe accidents
    a. Suppression systems
    b. Containment fan coolers
    c. Containment spray systems
    d. Residual Heat Removal
    e. Other

3. Containment air mixing during severe accidents

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SUMMARY

Sufficient knowledge exists to change the regulations for Combustible Gas Control

Focus must be on severe accidents

Proposed 10CFR50 Changes are a combination of
- Retain what is effective and efficient
- Add where necessary
- Delete what is not effective and efficient